

ESOH Requirements for UAVs

Boeing – St. Louis
Integrated Defense Systems

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UAVs

- Unmanned Air Vehicles
 - Used for Surveillance Missions

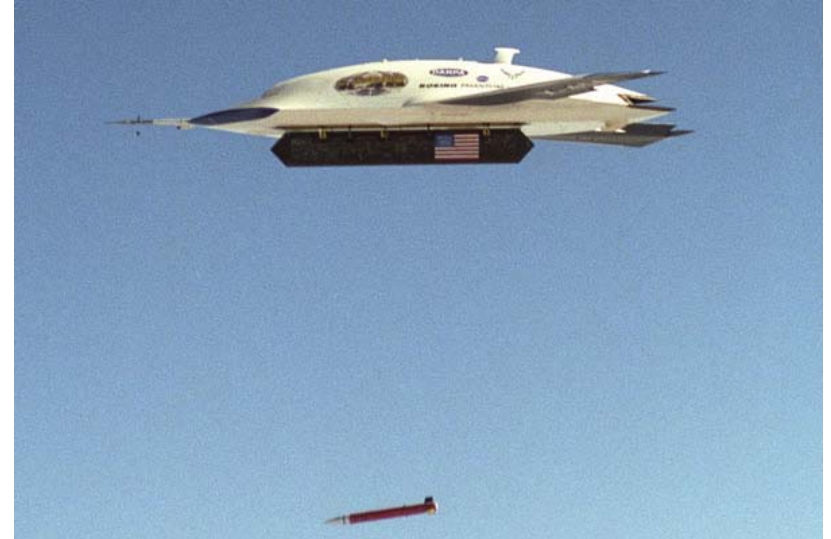


Scan Eagle Launch

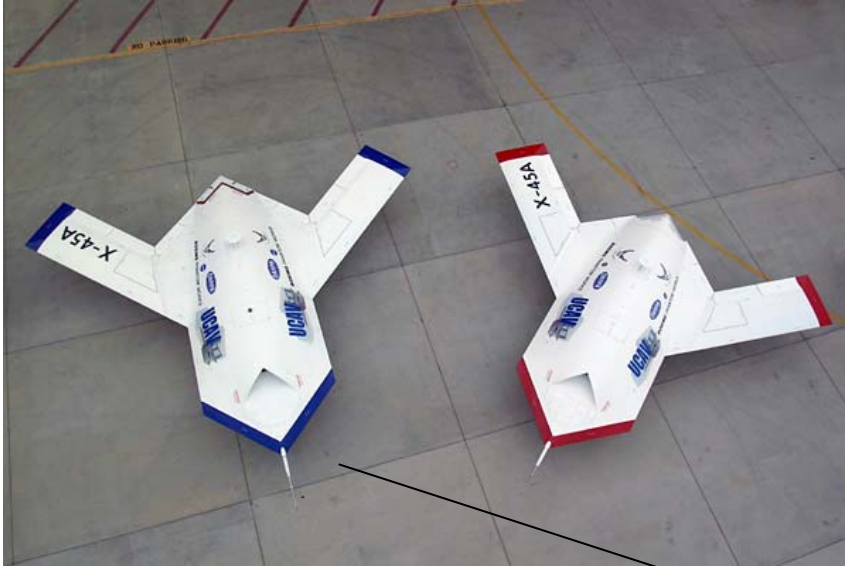


UCAVs

- Unmanned Combat Air Vehicles
 - Used for Strategic Bombing



X-45 UCAVs



ESOH Requirements for UAVs

- Environment, Safety and Occupational Health (ESOH) Requirements
 - UAV Proposals Meet All Federal, State and Local Regulations Regarding Hazardous Material Usage
 - Thoroughly Reviewed by Boeing
 - Contracts Are Modified and Updated to Reflect the Latest Regulations
 - Boeing Complies with All ESOH Requirements

Chromium and Cadmium Usage on UAVs

- Performance Specifications, System Specifications, Statement of Work for UAVs Do Not Restrict or Prohibit the Use of Cadmium or Chromium
 - Cadmium and Chromium Elimination is Not a Customer Requirement
 - However, Cadmium and Chromium Alternatives Are Used Because of Performance Issues
 - Titanium Landing Gear – *Increased Durability*
 - Stainless Steel Fasteners – *Corrosion Resistance*
 - Composite Structure – *Enhanced Performance*

Nickel and Cr⁺⁶ Metal Finishing Processes on UAVs

- Nickel Alternatives Are Not Considered Because They Do Not Exist
 - Cobalt Alternatives Are More Toxic Than Nickel
 - EPA and OSHA Will Increase Regulation When Usage Increases
- Cr⁺⁶ Alternative Processes for Aluminum Are Not Considered Because They Do Not Exist
 - Aluminum Conversion Coating
 - Current Alternatives Do Not Meet MIL-DTL-81706 Corrosion Resistance Requirement on 2024 Aluminum
 - TCP Qualification in Work
 - Anodize Seal
 - Low Chrome Seal - CONTAINS Cr⁺⁶
 - No Seal
 - Does Not Meet MIL-A-8625 Salt Spray Requirements
 - Chromic Acid Anodize
 - Still Needed for Parts with Entrapment

UAV Design Objectives

- Majority of Engineering Effort Is Spent on Meeting UAV System Performance Requirements
 - Speed, Altitude, Flight Time, Weight, Performance, Payload, etc.
 - Elimination of Cadmium and Chromium is Not a Priority Item
 - Need to Meet Cost and Schedule Targets
 - High Risk Options Such As Cadmium and Chromium Alternatives Impact Cost and Schedule

“Green” UAVs

- DoD Customers Need to Be Willing to Invest In “Green” UAVs
 - UAV System Requirements Should Prohibit Cadmium and Chromium (and Nickel and Cr⁺⁶ Metal Finishing)
 - Need to Eliminate Cadmium and Chromium from Initial Design Phase
 - Customer Needs to Be Willing to Pay Extra and Accept a Delayed Schedule for First Flight
 - Reduce or Modify Requirements
 - Work with OEMs to Build a “Green” UAV

Is Technology Available to Build a “Green” UAV?

- Before Customer Requires a “Green” UAV
 - Make Sure Technology is Available
 - Chrome Plate Replacements?
 - Need Hard Wear Resistant Coatings
 - » ID and OD Applications
 - Cadmium Plate Replacements?
 - Need Sacrificial Coatings That Protect Steel and Are Compatible with Aluminum
 - Can Replacements Contain Nickel, Cobalt, Cr^{+3} , or Cr^0 (HVOF Coating WC-Co-Cr)?

Remaining Needs

- Cadmium Plating Replacements
 - Prefer a Non-Embrittling Process
 - Or Need Embrittlement Test Results < 24 Hours
 - Need to Coat Both ID and OD Surfaces
- Chrome Plate Replacements
 - HVOF with Better Adhesion (No Spalling)
 - Non-HVOF Processes (Plating Bath or PVD)
 - Need to Coat Both ID and OD Surfaces
- Non Cr⁺⁶ Processes Needed to Work with Non-Cr Primers
 - Use a Coating Systems Approach
- Implementation Issues for Alternatives Exist

Scan Eagle UAV Participating in the UK Ministry of Defence's Trial Vigilant Viper off the Coast of Scotland

